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CENTRAL INTELLIGENCE AGENCY
WASHINGTON, D.C. 20505

31 MAR 1983

MEMORANDUM FOR: Director of International Security Affairs
Department of Energy

FROM: E. Wayne Boring
Director of Scientific and Weapons Research 25X1

SUBJECT: Evolution of Production Reactors [redacted] 25X1

Attached is the paper on evolution of production reactors which was requested by J. S. Beardall of OISA for the use of the Assistant Secretary for Defense Programs. [redacted] 25X1

[redacted] 25X1

[redacted] 25X1

E. Wayne Boring

Attachment:
as stated

cc: J. S. Beardall, OISA

[redacted] 25X1

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Central Intelligence Agency

Washington, D.C. 20505

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[redacted]

DIRECTORATE OF INTELLIGENCE

29 March 1983

EVOLUTION OF PRODUCTION REACTORS

Summary

The designs of reactors used to produce materials for nuclear weapons have been strongly influenced by changing needs of the associated weapons programs. Early reactors were relatively simple. They were designed for rapid construction to meet immediate demands for plutonium and, somewhat later, for tritium. As weapon material requirements have become more diverse and weapon development lead times have become longer, a clear trend has developed toward the use of complex reactors which can efficiently produce electric power as well as nuclear materials. The use of reactors which produce both power and nuclear materials will probably expand in those countries where this concept is not constrained politically. 25X1

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It is not possible to understand the evolution of production reactors in isolation from the evolution of nuclear weapons designs. The various weapon design stages (or generations), together with changing requirements for the rapid acquisition of weapons, have in large part dictated the production reactor concepts chosen to make nuclear materials. 25X1

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This memorandum was requested by the Director of International Security, DoE. It was prepared by 25X1 *the Nuclear Energy Division of the Office of Scientific and Weapons Research. Questions and comments are welcome and may be addressed to the Chief of the Nuclear Energy Division* 25X1

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[redacted] 25X1

In the earliest stage (unboosted fission weapons), the priority need for rapid acquisition of plutonium dominated all other considerations. Reactor choices were limited by the need for rapid construction, and designs involving technical complexity or innovation were rejected. As a result, early production reactors were relatively simple water-cooled or air-cooled designs and did not produce electric power. [redacted] 25X1 25X1

The advent of boosted fission weapons and thermonuclear weapons created a priority need for substantial quantities of a new reactor product, tritium. In several countries reactors were designed to optimize production of this material. As in the case of early plutonium production reactors, design choices were limited by the need for rapid construction, and only relatively simple designs were seriously considered. [redacted] 25X1 25X1

In more recent years, reactor products requirements have become more diverse. There is much less incentive to build a reactor dedicated to, or even optimized for, the production of single reactor product. Perhaps more important, the long lead times required to develop complex weapons systems allow nuclear materials requirements to be identified years in advance. This long lead time provides an opportunity to seek out more economical means of providing new poduction capacity or replacing aging production reactors. [redacted] 25X1

With the exception of the PRC, all thermonuclear powers have reacted to this situation by developing complex production reactor designs which can produce electric power as well as nuclear materials. In the United Kingdom and France, production reactor designs have evolved to the point where there is essentially no difference between commercial power reactors and production reactors. The USSR was the first country to experiment with dual-purpose reactors [redacted] 25X1 25X1

In those countries where this development is not politically constrained, it is likely that the trend toward the use of commercial power reactors for nuclear materials production will continue. Future production reactors may be dual-purpose by design like the French gas-cooled reactors; inherently dual-purpose, such as breeder reactors (of almost any type); or totally conventional power reactors supplemented by an isotope separation process to purify the reactor product to weapons grade. [redacted] 25X1

[redacted] 25X1

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